REMARKS

This Amendment is intended as a full and complete response to the Office Action dated November 9, 2009. In this Amendment, Claims 15 and 19 are amended to specify that the sulfur content of the hydrocarbon stream is reduced by removal of the aqueous solution of ionic reaction products formed by contacting the hydrocarbon stream with the reactive extraction agent. Claim 3 is amended to clarify that the sulfur is being removed from the hydrocarbon stream. Claim 20 is amended to clarify that water-soluble ionic sulfur compounds are formed.

Therefore, Claims 2-3 and 6-20 remain for examination. No new matter is added by these amendments, and their entry and favorable reconsideration is respectfully requested.

THE CLAIMED INVENTION

As discussed in the Amendment submitted on July 16, 2009, it is very well established that removal of sulfur compounds from hydrocarbons is an important undertaking. The present invention provides an alternative or complementary process to remove sulfur compounds from hydrocarbon streams using a newly discovered reaction chemistry involving conversion of sulfur compounds into ionic species which are highly soluble in water. As is very well known to those having ordinary skill in the chemical arts, ions are soluble in water, and essentially, or not at all soluble, i.e., they are insoluble, in hydrocarbon liquids. Therefore, the present invention represents a substantial improvement and significant contribution to the hydrocarbon fuel desulfurization arts by allowing sulfur compounds to be removed by extraction as ions in an aqueous solution.

THE REJECTIONS OF CLAIMS UNDER 35 U.S.C. §102 & 35 U.S.C. §103 ARE UNTENABLE IN LIGHT OF THE CLAIM AMENDMENTS

Claims 2-3 and 6-20 were variously rejected in the Final Office Action of November 16, 2009 under 35 U.S.C. §102(b) and 35 U.S.C. §103(a). In particular:

- Claims 2-3, 6, 12, 14-16 and 18-20 were rejected under 35 U.S.C. §102(b) as being anticipated by Keyworth U.S. Patent No. 4,816,139 (hereinafter "Keyworth");
- Claim 10 was rejected under 35 U.S.C. §103(a) as being unpatentable over Keyworth;

- Claims 7-9, 11 and 13 were rejected under 35 U.S.C. §103(a) as being unpatentable over Keyworth in view of Eberly, Jr. U.S. Patent No. 4,592,829 (hereinafter "Eberly, Jr."); and
- Claim 17 was rejected under 35 U.S.C. §103(a) as being unpatentable over Keyworth in view of Sughrue, et al. U.S. Patent Publication 2004/0007501 (hereinafter "Sughrue, et al.").

Applicants respectfully traverse all of the grounds of rejection set forth under 35 U.S.C. §102(b) and 35 U.S.C. §103(a), and submit that the amendments and additional explanation and arguments presented herein overcome the rejections.

SUMMARY OF THE NEW PRIMARY REFERENCE KEYWORTH U.S. PATENT 4,816,139

Keyworth is directed to a process in which low boiling monosulfides are converted to high boiling sulfones by contacting a hydrocarbon stream (preferably a stream of C_{10} or less) with NaOCl, i.e., sodium hypochlorite. The high boiling sulfones and other high boiling hydrocarbons are separated from the mixture by fractionation. The mechanism of reaction is described in the specification as being based on "decomposition of NaOCl in water [to produce] .. nascent oxygen which is the major source of its oxidizing ability." (Keyworth, col. 4, lines 58-60). Carbon disulfide is removed from the separated low boiling fraction by contact with a cation exchange resin.

In short, Keyworth describes an oxidative desulfization process in which oxidized products are removed with higher boiling organosulfur compounds. This reference is not concerned with reactive extraction process and reaction schemes.

SUMMARY OF THE SECONDARY REFERENCES

Eberly, Jr. U.S. Patent No. 4,592,829

The Eberly, Jr. reference was relied upon in the Office Action for the rejection of Claims 7-9, 11 and 13, and describes a process to remove organic sulfur compounds such as mercaptans, sulfides, thioethers, and disulfides from hydrocarbon streams by using an adsorbent or catalyst comprised of metallic nickel and iron, optionally supported on an inorganic oxide compound such as alumina. This reference is not at all concerned with catalysts for the purpose of

promoting the reaction between a reactive extractive agent and sulfur compounds present in a hydrocarbon feed.

Sughrue, et al. U.S. Patent Publication 2004/0007501

The Sughrue, et al. reference was relied upon in the Office Action for the rejection of Claim 17. Sughrue, et al. describes a desulfurization process in which a sulfur-containing hydrocarbon stream is contacted with an oxidizing agent upstream of a step of contacting with a sorbent comprising a promoter metal component and zinc oxide under. The reference is relied upon for its disclosure of perchloric acid and hypochlorites as oxidizing agents, mentioned among a plethora of other possible oxidants. Notably, this reference does not teach or suggest use of the disclosed oxidizing agents for reactive extraction of sulfur compounds.

THE CLAIM REJECTIONS SHOULD BE WITHDRAWN

Turning to the claim rejections in the instant application, Applicants believe that the above amendments and the following remarks will establish that any case of anticipation or *prima facie* case of obviousness raised has now been rebutted and that the rejections under §102 and §103 based on the cited references should be withdrawn.

In particular, with respect to independent Claim 15 and the claims dependent therefrom, Keyworth does not in any way disclose or suggest use of sodium hypochlorite as a reactive extractive agent.

Keyworth describes an oxidative desulfurization process whereby sodium hypochlorite decomposes in water to form noscent oxygen, resulting in oxidation of certain sulfur-containing hydrocarbons (Keyworth, col. 4, lines 58-60). The oxidative reactions favor only the low boiling sulfur-containing hydrocarbons. Oxidation products, i.e., sulfoxides and sulfones, have higher boiling points than the hydrocarbons affected by the oxidation reactions. Thus, the higher boiling portion, along with the oxidation products, are removed as bottoms from a fractionator.

In contrast, the mechanism of reaction in the process of the present Claim 15 is the formation of water soluble reaction products (as was stated in Claim 15 presented in the Amendment of July 16, 2009), and the sulfur content of the hydrocarbon stream is reduced by extracting the aqueous solution of reaction products (as presented in the current claim amendment).

This is a completely different scheme than that which is disclosed in Keyworth, whereby oxidation products are removed by fractionation. Rather than removing sulfur compounds as bottoms in a higher boiling hydrocarbon fraction, the process of the present Claim 15 removes sulfur content by reactive extraction. For instance, whereas carbon disulfide is removed from the separated low boiling fraction by contact with a cation exchange resin in the process of Keyworth, in the process of the present Claim 15, carbon disulfide is destroyed the reaction with sodium hypochlorite in the presence of catalyst, forming sodium bicarbonate and sulfate.

Further, with respect to independent Claim 19 and its dependent Claim 20, Keyworth does not in any way disclose or suggest a sodium hypochlorite as a reactive extractive agent, whereby the reaction chemistry forms chlorosulfonium ions as reaction products which are soluble in water, and removal of the sulfur from the hydrocarbon stream by removing the water layer phase from the treated hydrocarbon stream.

As such, it is submitted that Claims 15 and 19 are not anticipated by Keyworth. Since Keyworth does not disclose key limitations of these independent claims, even if the combination with Eberly Jr. and Sughrue, et al. were proper combinations - which Applicants do not in any way concede - the requirement that all of the claim limitations are met does not lead to a proper determination of obviousness under 35 U.S.C. §103. Furthermore, Claims 2-3, 6-14 and 16-18 depend, either directly or indirectly, from independent Claim 15 and recite additional novel features. Likewise, Claim 20 depends from Claim 19. As such, and for at least the same reasons discussed above, it is submitted that these dependent claims also fully satisfy the requirements for patentability under 35 U.S.C. §102 and 35 U.S.C. §103. Therefore, withdrawal of the rejection is respectfully requested.

With respect to the specific grounds for rejection of dependent Claims 7-9, 11 and 13, Applicants remarks as presented in the July 16, 2009 Amendment and Response are applicable. In particular, Eberly, Jr. is not at all concerned with catalysts for the purpose of promoting the reaction between a reactive extractive agent and sulfur compounds present in a hydrocarbon feed. Rather, the catalysts are used therein as sorbents.

In addition, regarding the grounds for rejection of Claim 17, Sughrue et al. does not teach or suggest use of the disclosed oxidizing agents for reactive extraction of sulfur compounds. Rather, Sughrue et al. uses these components only as oxidizing agents.

REQUEST FOR CONTINUED EXAMINATION & PETITION FOR EXTENSION OF TIME

This Amendment and the accompanying remarks are presented in conjunction with a Request for Examination and a Petition for a three month extension of time.

CONCLUSION

In view of the amendments, analyses and arguments presented above, Applicants respectfully submit that this Amendment addresses all of the points raised in the Office Action and that all of the claims are in condition for allowance. Accordingly, both favorable reconsideration of this application and prompt issuance of a Notice of Allowance are earnestly solicited.

If, however, the Examiner believes that there are any unresolved issues concerning any of the claims, we respectfully request that the Examiner telephone Ralph J. Crispino at (212) 885-9358 or Thomas E. Spath at (212) 885-9250 so that appropriate actions can be taken as expeditiously as possible to resolve such issues.

The Commissioner is hereby authorized to charge any additional fees, or to credit any overpayment, due by reason of this paper to Deposit Account No. 01-0035.

Respectfully submitted,

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